

MUSCULOSKELETAL DISORDERS IN PROFESSIONAL VIOLINISTS AND VIOLISTS. SYSTEMATIC REVIEW

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ABSTRACT

Due to the high physical and psychological demands of their work, musicians have a high risk of developing a range of health problems. The main causes of musculoskeletal disorders seen in instrumentalists are overuse, nerve compression and focal dystonia. The aim of this paper is to identify the musculoskeletal disorders that most frequently affect professional violinists and violists. 50 articles were read, of which 24 were used. The PEDro scale was used to determine the quality of the articles. The definition of risk factors can help in the development of prevention programs. Playing a musical instrument involves a combination of actions, including rapid, repetitive and complicated movements of the hands and fingers. The chairs used

offer no other option than to adapt to the demands of body posture. To achieve the necessary skills to become a musician of a high standard, many hours of training and perfection are required. The neck, shoulder and temporomandibular joints are the most commonly affected areas, due to prolonged flexion of the head and shoulder required to hold the violin. The elbow and fingers are also common sites of disorders. It is necessary to warn musicians of the initial symptoms, and how they can prevent the disorder from worsening. *Level I Evidence (Centre for Evidence-Based Medicine, Oxford, UK).*

Keywords: Muscle, skeletal /injuries. Occupational diseases. Risk factors.

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INTRODUCTION

Due to the high physical and psychological demands of their work, musicians have a high risk of developing a range of health problems. Musicians who play wind instruments can have dental stress and increased intraocular pressure, while those who play string instruments can have dermatitis and musculoskeletal disorders.¹

Violinists and violists often suffer from conditions in the jaw, back, neck, shoulder and hands, which can be either nerve related or muscular.² The disorders are caused by repetitiveness, inappropriate postures and stress brought about by remaining seated for a long time or carrying instruments.³ The main causes of musculoskeletal disorders seen in instrumentalists are overuse, nerve compression and focal dystonia.³⁻⁵ Pain is the main symptom of overuse lesions and musicians who play string instruments are the most affected.³

There are intrinsic and extrinsic factors for these disorders. The relationship between musicians and their instruments is the focal point of ergonomic analysis and biomechanical training, while postural alignment is essential, leading to appropriate neck and hand positions.¹

The work of violinists and violists requires a seated position throughout the entire rehearsal and performance period. They look for the best body position, seeking balance and distribution of body weight to obtain greater motor control and precision of movements in the instrumental execution.⁶

This article is justified by the need to identify the main disorders that affect these professionals so as to enable the subsequent preparation of preventive plans.

The aim of this paper is to identify the musculoskeletal disorders that most frequently affect professional violinists and violists.

MATERIALS AND METHOD

Articles, theses and dissertations sought in the Medline, Lilacs, Cochrane and Scielo databases were used in this study. The key words used were musculoskeletal disorder, lesions and musicians in Portuguese, English and Spanish. Only articles in Portuguese, English and Spanish were selected, without any deadline. Table 1 provides details of the combination of key words in the search in the databases. Manual search for bibliographies in magazines, books, by key authors and relevant information was also utilized.

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Inclusion and exclusion criteria

Studies that mentioned string instrumentalists, string instruments with bow, violinists and violists were included in the trial. Studies that did not report the type of musician or instruments played were excluded. (Table 1)

RESULTS

Of the articles found through the databases and through manual search, 58 were potentially selected and read. Of these, 30 fulfilled the initial inclusion criteria and were used in this study. Figure 1 details the search. The PEDro scale was used to determine the quality of the articles. (Table 2)

Table 1. Results of the Different Electronic Databases.

Database	Keywords	Results
MEDLINE	Musicians; musicians; injuries; musculoskeletal disorder; violinist; violist.	394
LILACS	Musicians; musicians; injuries; musculoskeletal disorder; violinist; violist..	47
Cochrane	Musicians; musicians; injuries; musculoskeletal disorder; violinist; violist.	38
SCIELO	Musicians; musicians; injuries; musculoskeletal disorder; violinist; violist.	62
Total number of citations		541

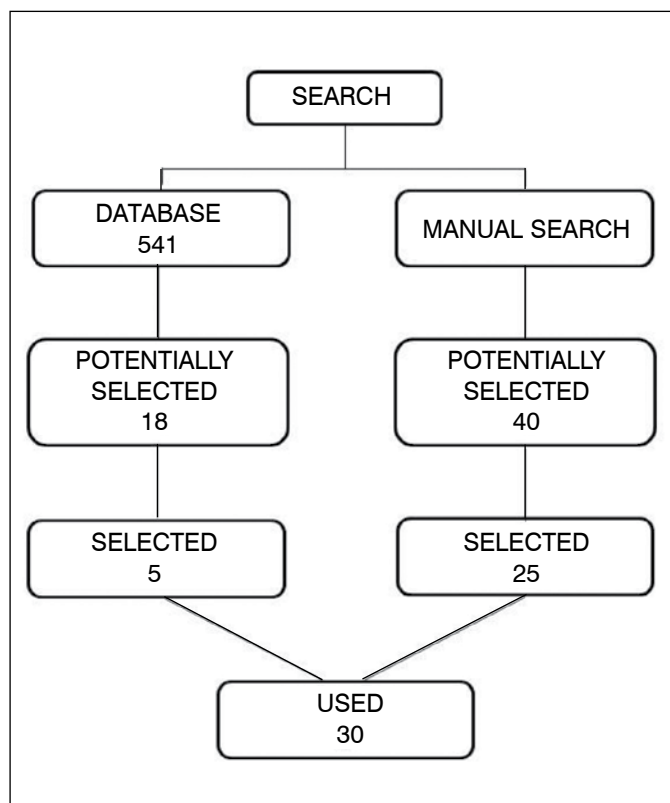


Figure 1. Search result.

DISCUSSION

Playing a musical instrument involves a vast combination of actions, including rapid, repetitive and complicated movements of the hands and fingers, which requires considerable effort from the muscles, ligaments and bones.⁷ According to Foxman *et al.*¹ and Lederman⁸, violinists have four times more pain in the right forearm. Hagberg *et al.*⁹ found that violinists have twice the risk of developing pain in the neck, right shoulder and left forearm, when compared with pianists.

Fry¹⁰ reports that musculoskeletal disorders are common in musicians and are characterized by pain and musculoligamentous strain, muscle weakness and loss of motor control in the affected segments.

The musculoskeletal problems observed most often in musicians are: overuse (50%), nerve compression or thoracic outlet syndrome (20%), focal dystonia (10%).¹

In his study, Lederman⁸ observed that in string instrumentalists, 69% had musculoskeletal problems, 19% conditions of the peripheral nerve, 5% focal dystonia and 7% others. Ostwald *et al.*¹¹ and Hayden¹² verified that 62% of violinists and violinists suffer from submandibular lesions due to the way in which they support the instruments.

The initial symptoms that frequently appear are pain, in approximately 85% of the cases, burning sensations, tiredness or heavy limb in one or more parts of the body, and they can arise even after a short time of activity.^{5,8,11}

The synthesis of the bibliographical review usually determines that the factor responsible for the musculoskeletal disorder in musicians is biomechanical. However, it is believed that other aspects should be considered in indicating the determinants of these dysfunctions.

The factors that predispose to illness are: sudden increase of sessions playing the instrument, inadequate exercise regimen, incorrect playing habits such as lack of warm-up and stretching of muscles, the technical issues of the instrument such as grip with excessive force or tension, change of instrument, inadequate rehabilitation of previous injuries, postures and inappropriate use of the body. Issues of individual and gender-related anatomical variability, the use of improper chairs, the execution of extra-musical activities that produce muscle tension, the quality of the instruments used and the conditions of the room, with low lighting and temperature, are also important factors.^{1,2,8,11} Changes of repertoire or of instrument are also risk factors. The repertoire is considered a critical parameter in relation to the levels of force and pressure produced during the performance, interacting with the accessories added to the instrument, such as the chin rest. The most influential risk factor, however, concerns the increase in the time of instrument use and of rehearsal periods.^{1,2,8,11}

Musculoskeletal injuries are defined as a set of conditions that can affect the musculoskeletal system, separately or in association, with or without tissue degeneration, mainly involving upper limbs, scapular region and neck.¹³ According to Brito *et al.*¹⁴, these injuries can appear in various forms, such as musculotendinous conditions, nerve compressions or motor dysfunctions. Musculoskeletal symptoms can range from discomfort to severe lesions and consequent inability to pursue professional

Table 2. Description of studies.

Study	Population	Methods	Results	PEdro Scale
Fry H (1988)	N: 175 Musicians from 9 symphonic orchestras and 11 schools	Patients with degree 1 and 2 overuse were treated conservatively. Those with a higher degree were submitted to radical rest treatment.	Violin: 22 treated. Of the 5 treated conservatively, 4 improved. Of the 16 treated radically, 8 were cured. Viola: 5 treated. All 4 treated conservatively were cured. 1 was treated radically and presented improvement of the condition.	3
Zaza C, Farewell V. (1997)	281 professional classical musicians and students from the Ontario Music University	Questionnaires and hypermobility measures were applied.	String musicians are 4x more likely to develop lesions related to playing music. Women were affected more.	5
Costa C (2003)	6 male violists, aged between 22 and 47 years.	There were semi-structured individuals interviews, an ergonomic work analysis and a printed questionnaire.	5 of the 6 subjects felt pain related to playing. Diagnoses: tendinitis, postural problem, psychosomatic problem and Repetitive Strain Injury (RSI). Treatment: physiotherapy (4 cases) and acupuncture (2 cases). The organization of the work allows them only a slight maneuvering margin to minimize the occurrence of pain.	1
Hagberg M, Thiringer G, Brandstrom L. (2005)	407 music students	A questionnaire was applied	Violinists have twice as much risk of developing pain in the neck, right shoulder and left forearm, when compared with pianists. Violists and violinists have a higher incidence of pain in the neck, shoulder, elbow and forearm than pianists.	2
Foxman I, Burgel B (2006)	10 musicians from the community	They answered a questionnaire about risk factors and problems related to musicians	9 were diagnosed with musculoskeletal disorder; the main sites of pain were: fingers, shoulder and spine; they presented the following risk factors: prolonged practice time, repetitive dexterous movements with the hands, remaining seated for long periods, working in an uncomfortable position.	2
Abréu-Ramos A, Micheo W (2007)	75 musicians from the Puerto Rico Symphony Orchestra	Questionnaire and neuromusculoskeletal evaluation	81.3% reported musculoskeletal disorders. Of these, 83.6% reported correlation with practicing. Lumbar pain was mentioned by 75.4%. Violinists and violists reported pain in the cervix and left shoulder.	3
Nyman T, Wiktorin C, Mulder M, Johansson Y. (2007)	235 musicians from Swedish orchestras.	They answered a questionnaire, and were split into groups: neutral arm position <2 hr/day of work; neutral arm position>3 hr/day of work; elevated arm position<2 hr/day of work; elevated arm position>3 hr/day of work	25.5% of the 235 musicians reported cervical and shoulder pain. In the group corresponding to violin and viola, 35.3% reported cervical and shoulder pain.	4
Stechman Neto et al (2009)	92 musicians (70 wind instrument musicians and 22 string instrument musicians)	Explanatory speech about temporomandibular dysfunctions and interview.	Of the 39 musicians who reported that they have noticed they grind and/or clench their teeth, 5 are string musicians, playing the viola and violin, reported the presence of this habit while they are playing the instrument. 23 musicians, with 19 playing wind instruments and 4 playing string instruments, respectively, said they felt pain in the TMJ. 19 musicians from both groups reported difficulty opening their mouths wide. 39 musicians reported the presence of noises in the TMJ, whereas 27 belong to the group of wind instrumentalists and 12 to the group of string instrumentalists.	4

activities and leave from work as well as interruption of the domestic routine.^{15,16}

In a retrospective study to discover the reasons why musicians sought orthopedists in the period from 1994 to 2001, Nourissat *et al.*¹⁷ verified that two thirds of the total of 227 musicians exhibited some disorder of the musculoskeletal system.

In their study, Andrade and Fonseca¹⁸ found that the type of instrument had little influence on the occurrence of physical discomfort, but the viola and the double bass presented a higher proportion of individuals who had to interrupt the instrumental activity.

However, epidemiological studies encountered very different results in terms of general prevalence of problems in a single instrument: sometimes the violinists and violists are more affected by problems, sometimes they present fewer symptoms.¹⁹

A study that investigated temporomandibular dysfunction in 92 musicians, including 22 violists and violinists, found that 25% of the musicians had a history of temporomandibular pain, including 18 string instrumentalists. Joint clicking was found in 54.54% of the string musicians.²⁰ Neck and jaw positioning while playing, excessive pressure applied to hold the instrument and occlusion with excessive force, are the primary causes of temporomandibular dysfunction. More problems were found in the violists. Symptomatic violinists and violists can alter their technique to reduce the force caused by the instrument on the jaw, reducing pain and dysfunction.^{20,21}

The cervical spine can also be affected due to the prolonged head and neck position used to hold the instrument. This position can cause muscle spasms and nerve compression. Playing any instrument requires precision work with hands and fingers, which in turn requires stabilizing activity in the musculature from the neck and shoulder region.^{8,22-26}

In the study by Nyman *et al.*²², there was prevalence of pain in the neck and shoulder of 35.3% in the group containing violists and violinists. Hagberg *et al.*⁹ found that violists and violinists have a higher incidence of pain in the neck, shoulder, elbow and forearm than pianists.

The violin and the viola require an extreme external shoulder rotation position, arm elevation and constant maximum supination of the left forearm, which can lead to bursitis and tendinopathies of the shoulder muscles. The consequent load on the tendons of the muscles adjacent to the shoulder can cause overuse injuries, and it should be considered that continuous arm elevation increases intramuscular pressure.^{19,22,26} Violists report more pain in the shoulder and arms due to the greater weight and size of the viola compared to the violin.²⁷

Violinists and violists showed the predomination of disorders in the left upper limb such as tendinitis and compressive syndromes. The left hand of violinists presents around twice as many problems as the right hand, which may derive from the more awkward position required of the wrist and fingers in executing the fingering movements.¹⁹ Flexors and extensors of the right hand are used to control the bow and the muscles that keep the left hand in ulnar deviation as well as the finger extensors can also present overuse.^{8,12,19,21}

The maintenance of the seated posture throughout the practice period, associated with the technical posture adopted by the

violinist and violist, represents a considerable factor of discomfort for the performance of the activity, due to the increase in muscle effort required to maintain the postures as well as the reduced blood flow, which favors the appearance of painful processes.^{6,22}

As the chairs do not present adjustment devices, they offer no other option than the body's adaptation to the postural requirements involved in playing the violin.⁶

Postural issues were associated with discomfort in at least 90% of the musicians in the study by Andrade and Fonseca.¹⁸

According to Medoff and Hallberg²⁸, the most common problems during the seated posture are poor positioning of the feet, pelvic rotation, increase of lumbar lordosis and its rotation to the right, thoracic rectification, elevation of shoulders and elbows, head bent and turned to the left.

The fact that these musicians occupy the same position at work on a daily basis conditions the body posture in the handling of the instrument and the direction in which they look at the score, while the reading of the score is executed by pairs, and by the conductor. When the position is modified, it is necessary to make modifications of movements with the violin/viola and adjustments in the field of view to read the score and to observe the conductor's gestures. These adjustments generate physical demands in postural arrangements, especially as this change in the position of the queue does not occur frequently, which precludes automation in the use of the body.^{6,22,27}

The violinist/violist plays in three different environments, the rehearsal hall and the theater, the stage and the orchestra pit, while the furniture of the rehearsal hall is different from the stage and from the pit, which requires chair and music stand positioning adaptations to improve the visualization of the conductor and of the score.^{6,22}

According to Ostwald⁸, reduction of practice time, warm-up prior to playing, incorporation of rest periods during training sessions, correction of improper techniques, adequate eating habits and hydration aid in the prevention of injuries. The provision of adequate information to musicians, ergonomic attitudes represented by adequate posture at home and at work, use of appropriate furniture and awareness regarding postural problems as a means of disease prevention are also useful.²⁹

Modifications of incorrect technique, changes in playing habits, periods of rest, training of correct postures, frequent stretching exercises and use of chin and shoulder rests are helpful in the treatment of various abnormalities.^{4,8,10,11}

The use of the chin rest and of the shoulder rest at appropriate heights, can alleviate discomfort, even if they increase the weight of the instrument by up to 20%.²⁷

According to the study by Levine and Irvine³⁰, biofeedback has been used as a form of treatment and prevention, in the attempt to minimize unnecessary stress, especially in violinists.

To achieve the necessary dexterity to become a high-level musician, it is necessary to put in many hours of training and improvement, which can take years of practice to reach such "perfection". Excessive practice can predispose to the appearance of mild to severe lesions.

CONCLUSION

The neck, shoulder and temporomandibular joint are the most commonly affected areas due to prolonged flexion of the head and shoulder required to hold the violin. The elbow and fingers are also common sites of disorders. It is necessary to warn musicians of the initial symptoms, and how they can prevent the disorder from worsening.

As prevention is the best strategy, incorrect postures, incorrect

methods and considerable discrepancy between the size of the musician and violin should be avoided, and if they already exist, corrected. Maintenance of the instrument and appropriate use of furniture should not be ignored.

Most studies do not mention the specific categories of musical instruments. Few specific studies about musculoskeletal disorders in violinists and violists were found, which makes it necessary to carry out more studies related to this population.

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